


Surgical Position of Lateral-Tilted Supine is Suitable for Proximal Humeral Fracture Operations in Geriatric Patients

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Yun-fa Yang, MD, PhD¹ , Jian-wen Huang, MM¹, Xiao-sheng Gao, MM¹, and Zhong-he Xu, MD¹

Abstract

Objective: To report a new surgical position of lateral-tilted supine (LTS) for geriatric proximal humeral fracture operations. **Methods:** Between January 2016 and December 2020, we adopted the LTS position for operations in 65 geriatric patients with proximal humeral fractures. **Results:** Sixty-five patients including 25 males and 40 females aged 80.3 ± 8.5 years. The LTS position could be used for almost all proximal humeral fracture surgeries, such as ORIF with plate, suture anchor, and other fixation in 4 patients, open reduction and internal fixation (ORIF) with multiLoc nailing in 48, and shoulder hemiarthroplasty (SHA) in 13. Surgical position setting times were 11.47 ± 2.14 min. The systolic blood pressure changes before and after positioning were 15.07 ± 8.72 mmHg. All of the C-arm X-ray directions, including the cephalic side, contralateral side, and ipsilateral side, can be used in the LTS position surgeries. No surgical complications or no surgical position-related complications were found in these 65 cases. **Conclusion:** The surgical position of LTS is suitable for geriatric proximal humeral fracture operations.

Keywords

proximal humeral fractures, operative treatment, surgical position, clinical analysis, the elderly

Introduction

Proximal humeral fractures are common. Approximately 80% of proximal humeral fractures can be treated conservatively. Surgical treatment is indicated based on the fracture pattern, patient-related factors, and the risk of avascular humeral head necrosis. Based on the regional bone quality and patient's general conditions, Neer-2 fractures with metaphyseal comminution and Neer-3 or Neer-4 fractures can be a significant functional recovery as the result of anatomical reduction or good reconstruction.¹

Since most of the Neer-3 or Neer-4 proximal humeral fractures are clinically treated by surgeries, we should concern about the surgical position to reduce the risks during surgeries. Therefore, a surgical position is very important to complete the surgeries successfully. The surgical position should be safe and convenient for both

patients and surgeons. And the surgical position should also be easy to set up.

Nowadays, there are almost two kinds of surgical positions: the beach-chair (BC) position and the supine position, for mainstream usage in proximal humeral fracture operations.

¹Department of Orthopaedic Surgery, Guangzhou First People's Hospital, The Second Affiliated Hospital, School of Medicine, South China University of Technology, Guangdong, China

Corresponding Author:

Yun-fa Yang, Department of Orthopaedic Surgery, Guangzhou First People's Hospital, the Second Affiliated Hospital, School of Medicine, South China University of Technology, 1 Panfu Road, Guangzhou, 510180, Guangdong, China.
Email: yangyunfamd@163.com, eyyangunfa@scut.edu.cn



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As we know that the supine position is much easier and cheaper than the BC position in setting up, and the supine position is much safer and more convenient than the BC position for the patients. However, the supine position is not convenient for orthopedists in performing surgeries. Therefore, rather than the supine position, most orthopedic surgeons select the BC position for proximal humeral fracture operations.

However, the BC position has many disadvantages, especially for the elderly. Because in the BC position, hyperextension or rotation of the head can decrease vertebral artery blood flow, which exacerbates infarcts of the posterior cerebral circulation.² Complications associated with the BC position include venous air embolism, hypotensive bradycardic events, neurapraxia of cutaneous nerves of the cervical plexus, and hypoglossal nerve palsy.²⁻¹⁵ Although venous air embolism is very rare in open surgery and hypotensive bradycardic events can be prevented by properly stabilizing the head and neck in a neutral position,^{4,16-18} by adequate management of blood loss or fluid deficits, by avoiding the usage of some anesthetics which contain the components of epinephrine, and by utilizing medicines such as beta-blockers intraoperatively.¹⁹ Hypotensive bradycardic events may result in cerebral ischemia, which can cause severe ischemic injuries to the brain or spinal cord.^{2,15,20} Therefore, the BC position is still full of challenges during surgeries.

Consequently, to reduce the complications caused by the BC position, some researchers reported some modified surgical positions for shoulder operations.²¹⁻²⁴ Are there any surgical positions that are easy, safe, and convenient for not only elderly patients but also orthopedists?

Between January 2016 and December 2020, we adopted a new surgical position of the lateral-tilted supine (LTS) for proximal humeral fracture operations. We have found that the LTS position is easy, safe, and convenient for both patients and orthopedists, so we think that the LTS is suitable for geriatric proximal humeral fracture operations. Herein, we report our 5-year experience in the LTS position for proximal humeral fracture operations in the elderly.

Patients and Methods

Patients

The study was approved by the Ethics Committee of Guangzhou First People's Hospital. All patients who underwent proximal humeral fracture operations between January 2016 and December 2020 were included. The exclusion criteria were patients (1) aged less than 60 years, (2) suffering from poly-trauma, (3) with pathological fracture, and (4) without preoperative or postoperative radiographs.

After meeting the exclusion criteria, 65 eligible patients enrolled for retrospective analysis in this study. Age, gender, fracture classification, American Society of Anesthesiologists (ASA) evaluation, surgical position, operation methods, surgical position setting time, blood pressure changes before and after surgical position setting, and intraoperative C-arm X-ray directions for standard AP view and Lateral view, surgical complication, and surgical position-related complications were collected and analyzed.

Surgical Position Setting of LTS

The essential equipment required in the setup of the LTS position includes the support devices to stabilize the patient in the LTS position and padding for the bony prominences. The stabilization device to maintain the LTS position can be the waist or shoulder support device, vacuum bean bags, or primitive padding, which can obtain the firm boundary for the patient's torso or a rigid LTS position system. Bean bag has the advantage in keeping the patient's torso tilts about 30° accordingly.²⁵ Additionally, these different degrees of the LTS position have been proposed as an easier position in case of conversion to another procedure during surgery since the bean bag may be easily flattened or removed away and the patient can be gently leaned backward in the safe supine position.²⁶ This also may save surgical time and reduce the risk of contaminating sterile supplies by obviating the need for a new drape and preparation of the shoulder and the extremity.²⁶ (Figure 1)

Clinical data including age, gender, fracture classification, American Society of Anesthesiologists (ASA) evaluation, surgical position, operation methods, surgical position setting time, blood pressure changes before and after surgical position setting, and intraoperative C-arm X-ray directions for standard AP view and Lateral view, surgical complication, and surgical position-related complications were collected and analyzed.

Statistical Analysis

Measurement data were presented as the mean \pm SD. Statistical analyses were performed by the independent-samples student *t*-test. Categorical variables were analyzed by the chi-square test. Significant differences were considered when $P < .05$.

Results

After meeting the inclusion and exclusion criteria, 65 eligible patients who underwent proximal humeral fracture operations based on the LTS position between January 2016 and December 2020 enrolled for retrospective analysis in this study.

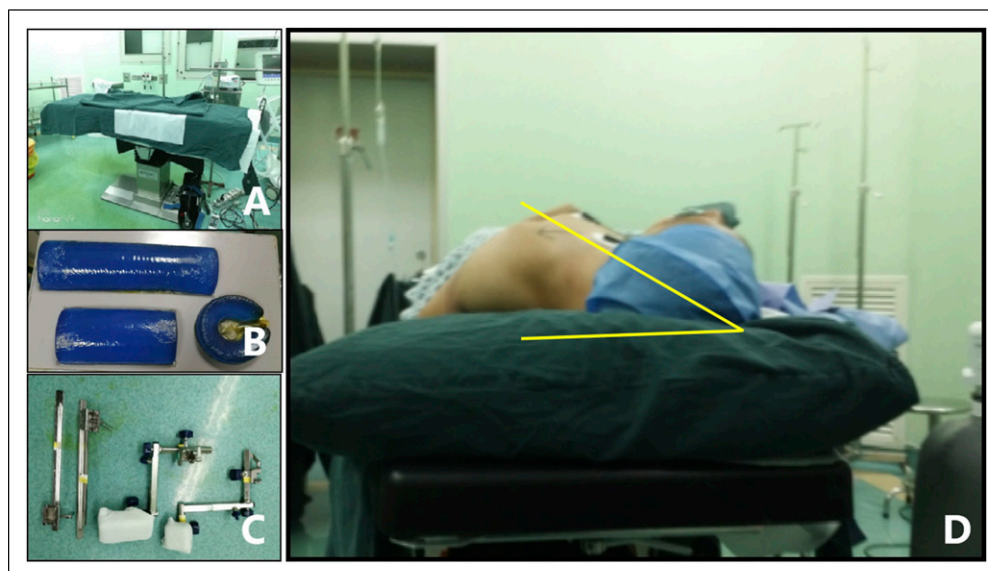


Figure 1. An illustration about the LTS position and its devices. Surgical table (A); Bean bags (B); Support devices (C), and the LTS position, usually tilts at 30 degrees (D).

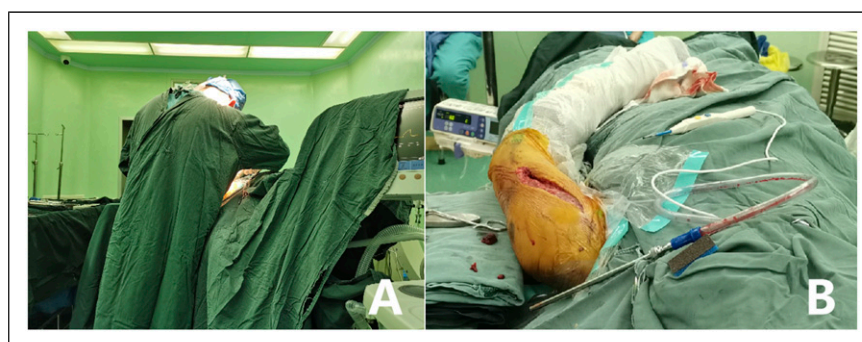


Figure 2. The surgeon's position (A), and the surgical incision of deltopectoral extension approach (B).

The 65 patients, including 25 males and 40 females, were aged 80.3 years (ranging from 60 to 104 years). Fracture classification included 33 of Neer-2, 28 of Neer-3, and 4 of Neer-4 and/or dislocation. American Society of Anesthesiologists (ASA) evaluation: ASA II in 30, III in 32, and IV in 3. Operation methods include ORIF with plate, suture anchor, and other fixation in 4 patients, ORIF with MultiLoc nailing in 48, or shoulder hemiarthroplasty (SHA) in 13. (Figure 2-5)

Systolic blood pressure changes before and after surgical position setting and surgical position setting times were shown in Table 1 (Table 1). The systolic blood pressure changes were 15.07 ± 8.72 mmHg. The surgical position setting times were 11.47 ± 2.14 min.

C-arm X-ray direction on the cephalic side in 10 patients, contralateral side in 52, and ipsilateral side in 3 were adopted for standard AP view and Lateral view X-ray, intraoperatively. Most patients completed X-rays on the

contralateral side, which could effectively reduce the potential risk of contaminating the surgical field. (Figure 6)

There were no surgical or surgical position-related complications in these cases.

Discussion

Proximal humeral fractures are very common. Most of the Neer-3 or Neer-4 proximal humeral fractures are clinically treated by surgeries. In order to obtain the safety of the surgeries, the surgical position should be safe and convenient for both patients and surgeons, and also be easy to set up. We find that the LTS position is easy, safe, and convenient for both orthopedists and elderly patients with proximal humeral fractures. Therefore, the LTS position is suitable for geriatric proximal humeral fracture operations.

The LTS position has many advantages. Firstly, the LTS position is safe and convenient for the patients. The LTS

Table 1. Clinical data of LTS position.

Clinical Data	N = 65
Age (years)	80.3 ± 8.5
Gender	
Male	25
Female	40
Fracture site	
Left	39
Right	26
Neer classification	
Neer II	33
Neer III	28
Neer IV	4
ASA	
2	30
3	32
4	3
Surgical type	
plate, screw, anchor	4
MultiLoc nail	48
SHA	13
Surgical position setting time (min)	11.47±2.14
Bp changes before and after positioning (mmHg)	15.07±8.72
C-arm X-ray	
Cephalic side	10
Contralateral side	52
Ipsilateral side	3
Surgical position related complications	0
Surgical complications	0

Bp, Blood pressure; ASA, American Society of Anesthesiologists; SHA, shoulder hemiarthroplasty.

position has few Systolic blood pressure changes, which can dramatically reduce the complications such as hypotensive bradycardic events. Secondly, the LTS position is to be safe and convenient for surgeons. Intraoperative standard AP view and Lateral view X-ray are very important for successful surgeries. All of the C-arm X-ray directions, including the cephalic side, contralateral side, and ipsilateral side, can be used in the LTS position surgeries. And most patients in the LTS position can complete standard X-rays on the contralateral side, which can effectively reduce the risks of fracture-related infection because of the potential decreased contamination of the surgical field. Thirdly, the LTS position is also convenient for intraoperative anesthesia management. Finally, the LTS position is easy to set up. The LTS position can be set up on the commonly used surgical table.

The LTS position has wide indications for almost all proximal humeral fracture surgeries. In this study, almost all the operation methods for treatment of proximal humeral fractures including ORIF with plate, suture anchor, and other fixation in 4 patients, ORIF with

multiLoc nailing in 48, and shoulder hemiarthroplasty (SHA) in 13 were successfully adopted based on the LTS position.

Eight key-step of LTS positioning for successful surgeries include (1) Taking the geriatric patient the challenges of positioning into full consideration before positioning; (2) Keeping all required equipment available and working properly; (3) Tilt the patient onto the non-operative side; (4) Stabilizing patients' head together with the anesthesia team during positioning; (5) Ensuring the head in the neutral position during the procedure to prevent cervical strain; (6) Positioning the contralateral arm carefully; (7) Placing the pillow or bean bag in the genitals, areola, or bony prominences, under the bottom knee and between the knees to avoid pressure injuries and to reduce any undue pressure from the bean bag or the rigid position system; (8) Securing the patient to the table using a safety strap to maintain the position during the surgical procedure.²⁷

In conclusion, the surgical position of LTS is suitable for geriatric proximal humeral fracture operations.

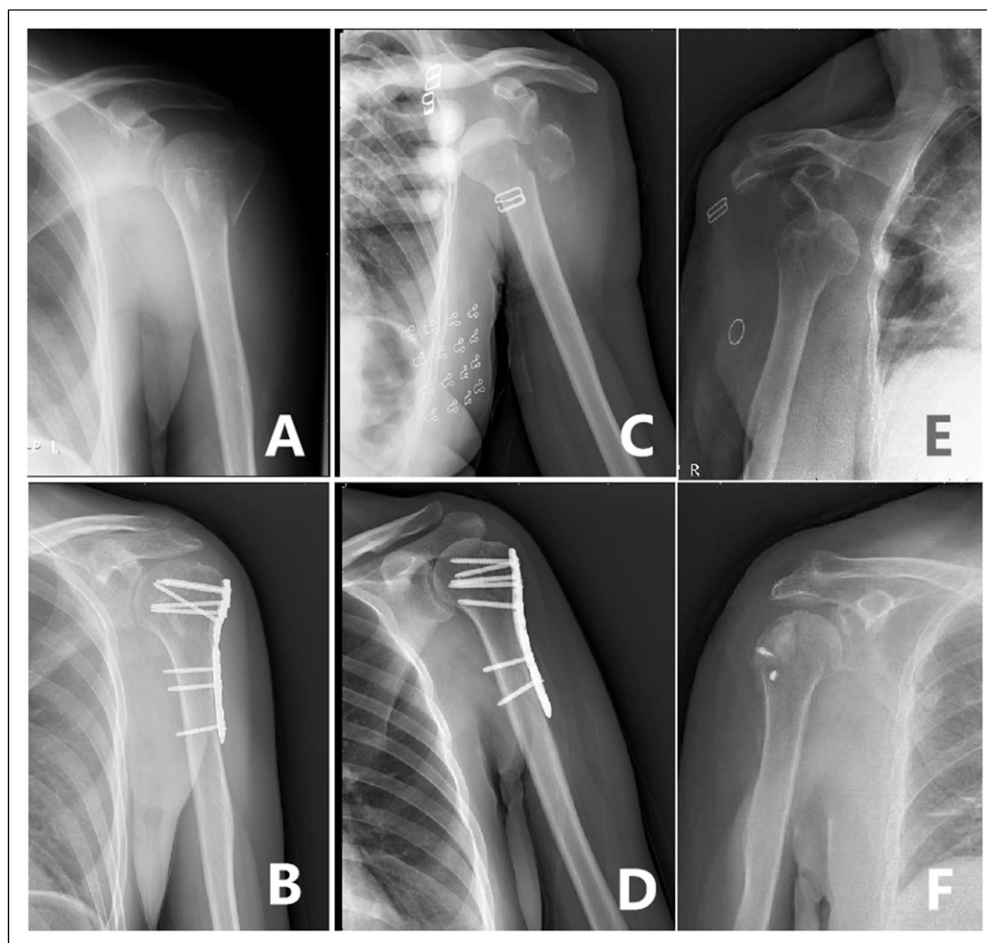


Figure 3. The ORIF surgeries with plate, screws or suture anchors based on the LTS position. Proximal humeral fracture with ORIF by plate and screws (A, B); Proximal humeral fracture and dislocation with ORIF by plate and screws (C, D); Proximal humeral fracture and dislocation with ORIF by suture anchors (E, F).

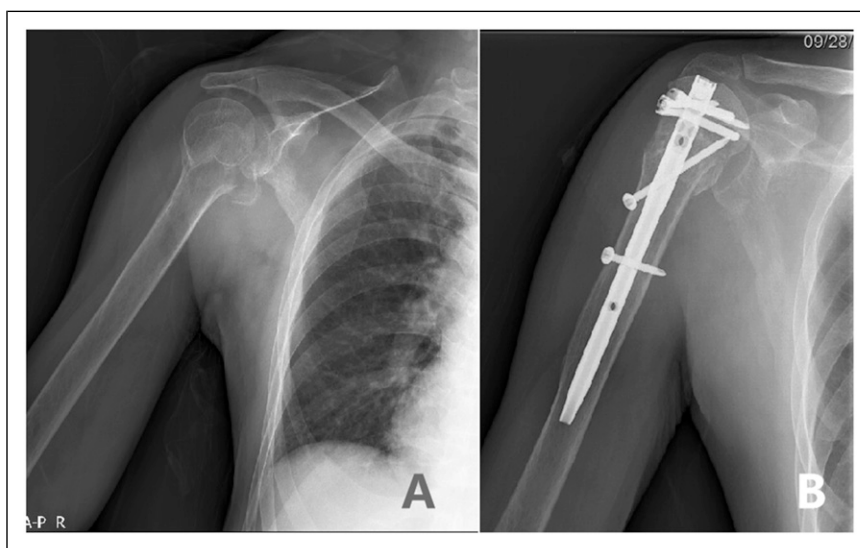


Figure 4. The ORIF surgeries with nailing based on the LTS position. Neer-4 fracture (A); ORIF with multiLoc nailing (B).

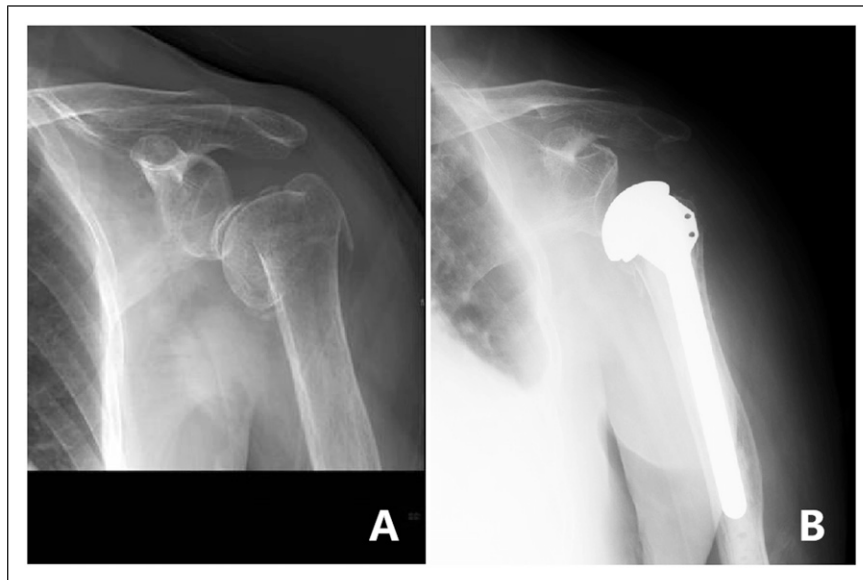


Figure 5. Shoulder hemiarthroplasty (SHA) based on the LTS position. Proximal humeral fracture, serious osteoporosis (A); Shoulder hemiarthroplasty (B).

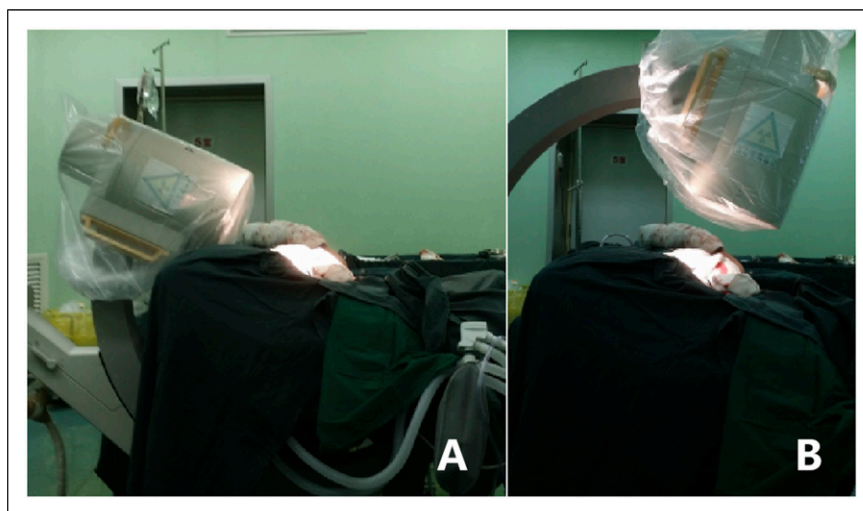


Figure 6. C-arm X-ray contralateral directions based on the LTS position during surgeries. For AP view X-ray (A); For lateral view X-ray (B).

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Authors Contributions

All authors contributed to the study conception and design. The study was designed by Yun-fa Yang. Material preparation, data collection and analysis were performed by Yun-fa Yang, Jian-wen Huang, Xiao-sheng Gao, and Zhong-he Xu. The first draft of the

manuscript was written by by Yun-fa Yang. All authors read and approved the final manuscript.

Declaration of Conflicting Interests

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Author Note

All the authors have approved manuscript for publication

Ethics Approval

The study was approved by the Ethics Committee of Guangzhou First People's Hospital.

Informed Consent

All patients in this study provided written informed consent after related complications and possible outcomes had been explained.

Data Availability

The dataset supporting the conclusions of this study is available upon request by contacting the corresponding author, but the primary data were not shared because other studies related these primary data were underway confidentially.

ORCID iD

Yun-fa Yang  <https://orcid.org/0000-0003-3722-326X>

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